

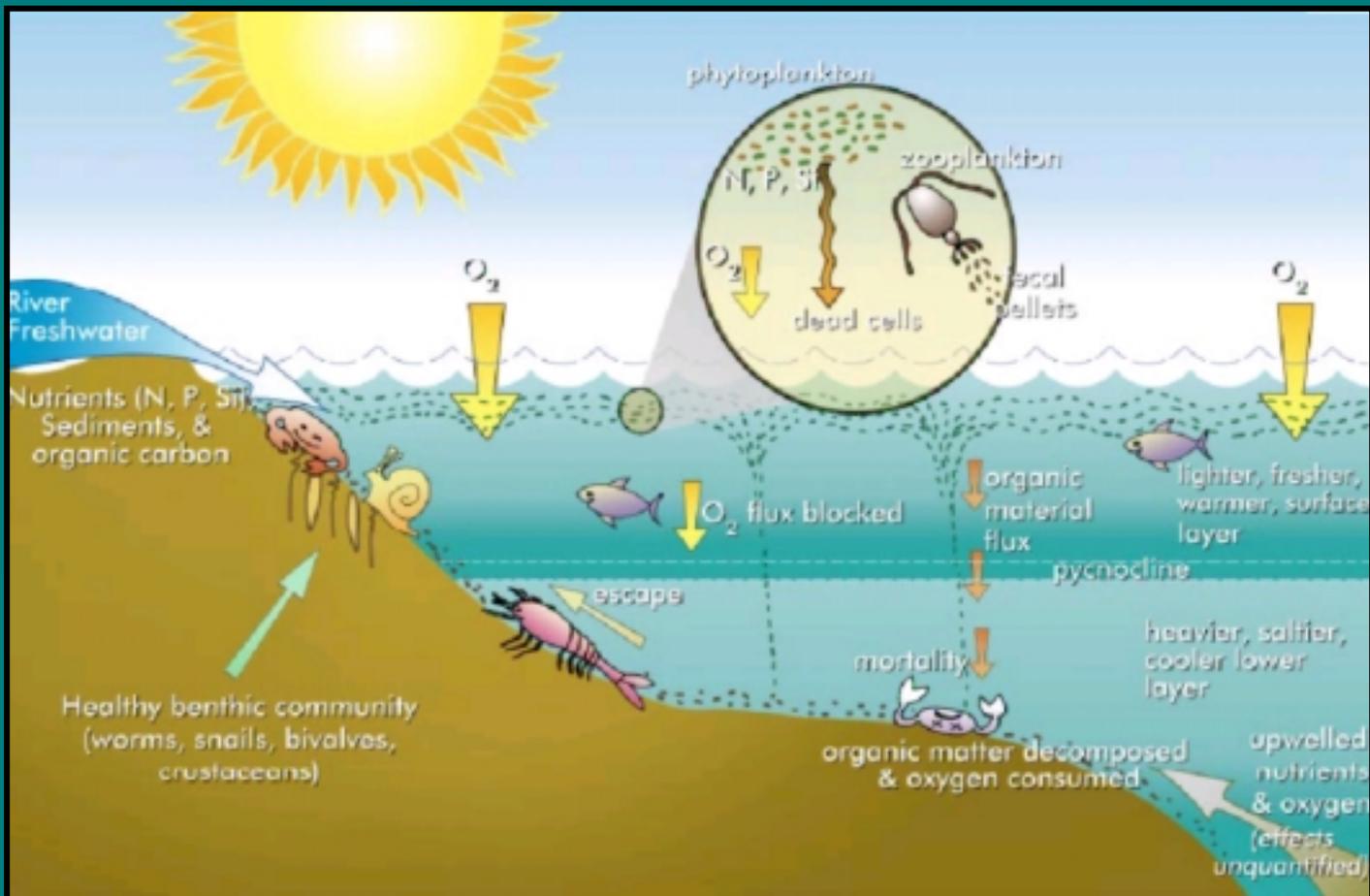


Gulf of Mexico Hypoxia and Nutrient Management in the Mississippi River Basin

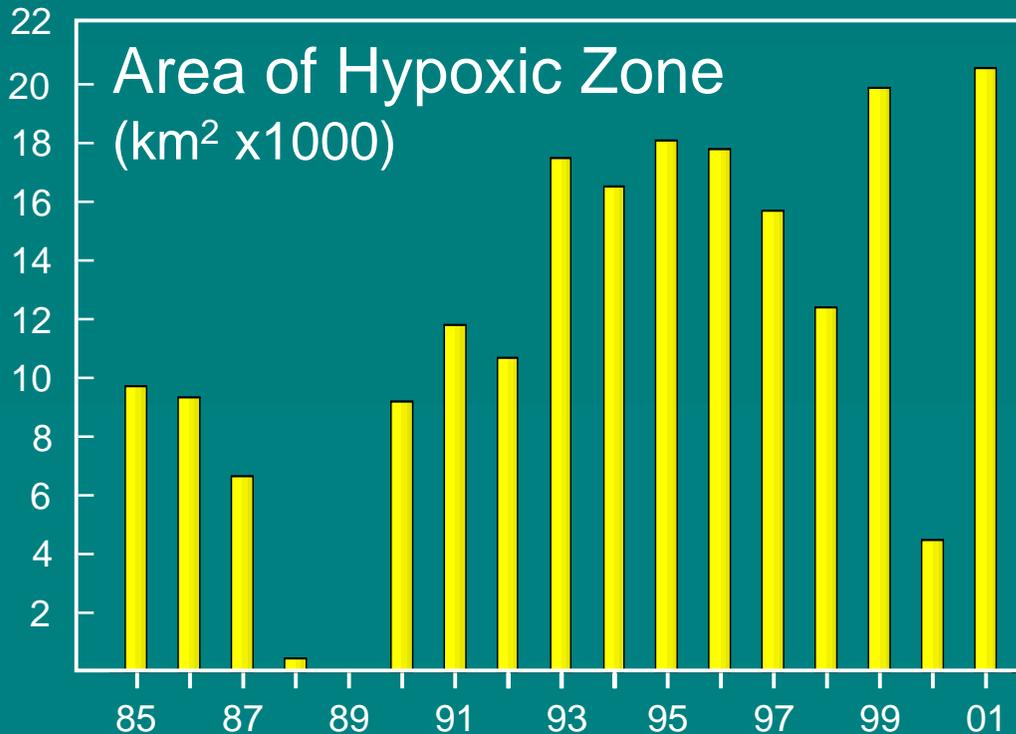
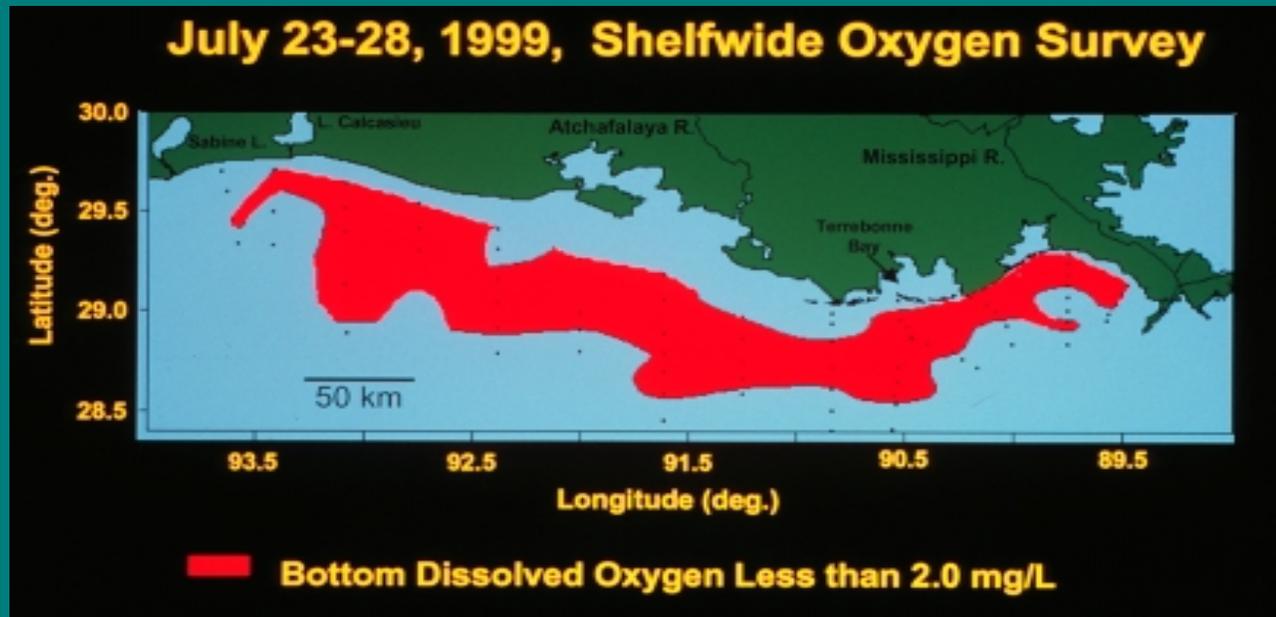
Herb Buxton,
U.S. Geological Survey

What Causes Gulf Hypoxia?

“Hypoxia in the Northern Gulf of Mexico is caused primarily by excess N delivered by the MR Basin in combination with stratification of Gulf Waters.” – *Integrated Assessment, 2000*



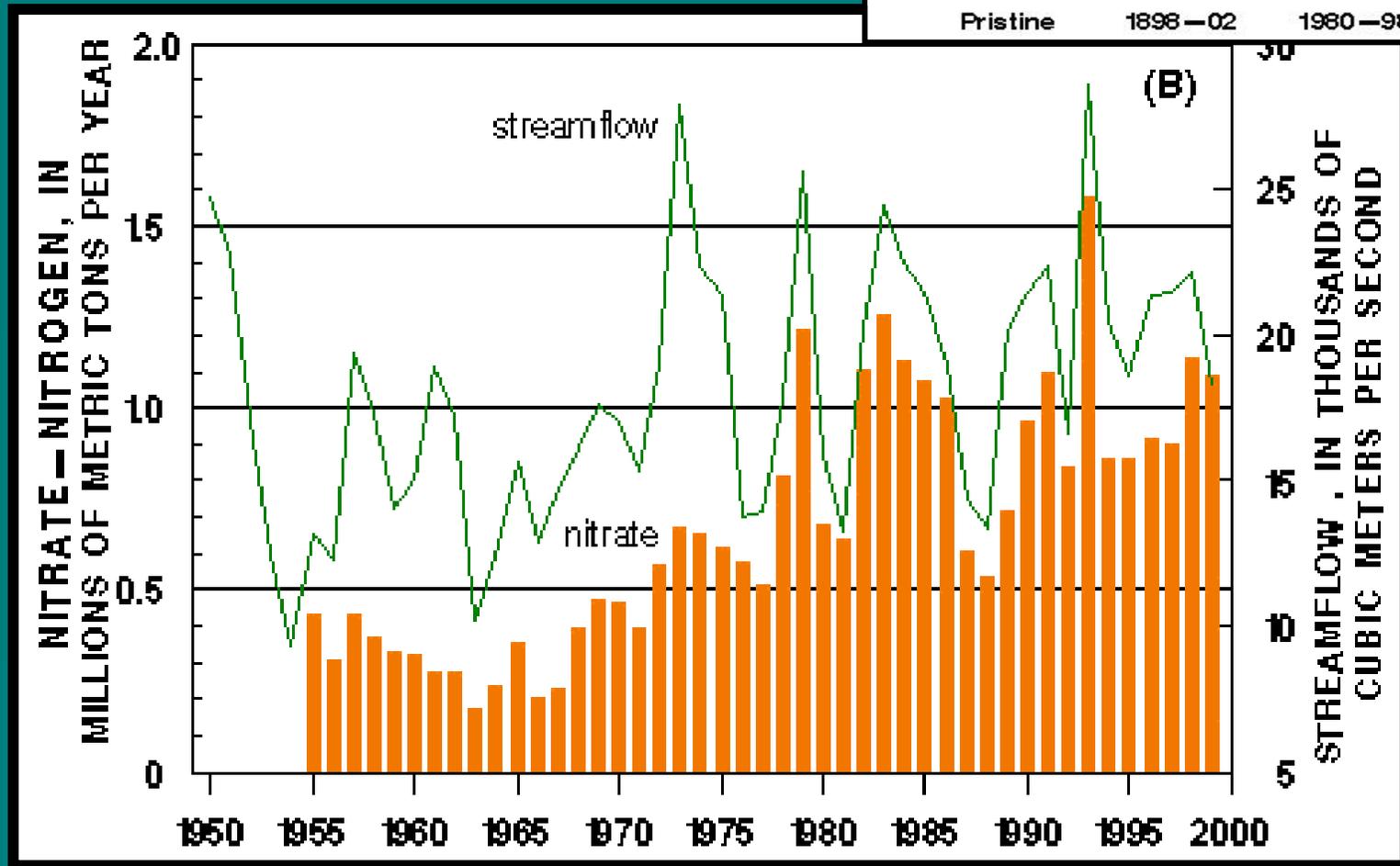
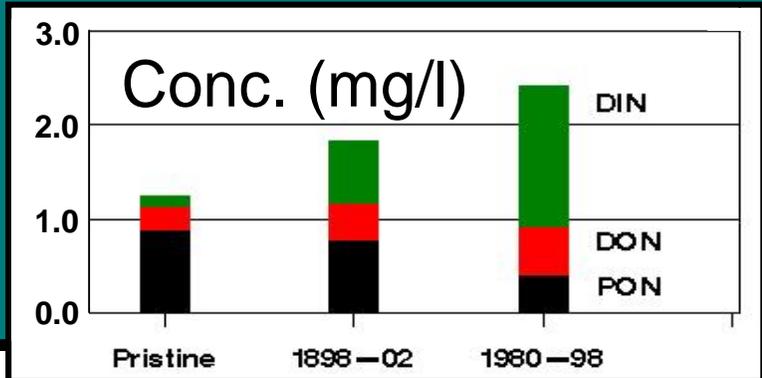
Gulf Hypoxia



Hypoxic Zone

- Measured 1985-2000
- Largest extent, 2001

NITRATE LOAD, ANNUAL STREAMFLOW AND N CONCENTRATION

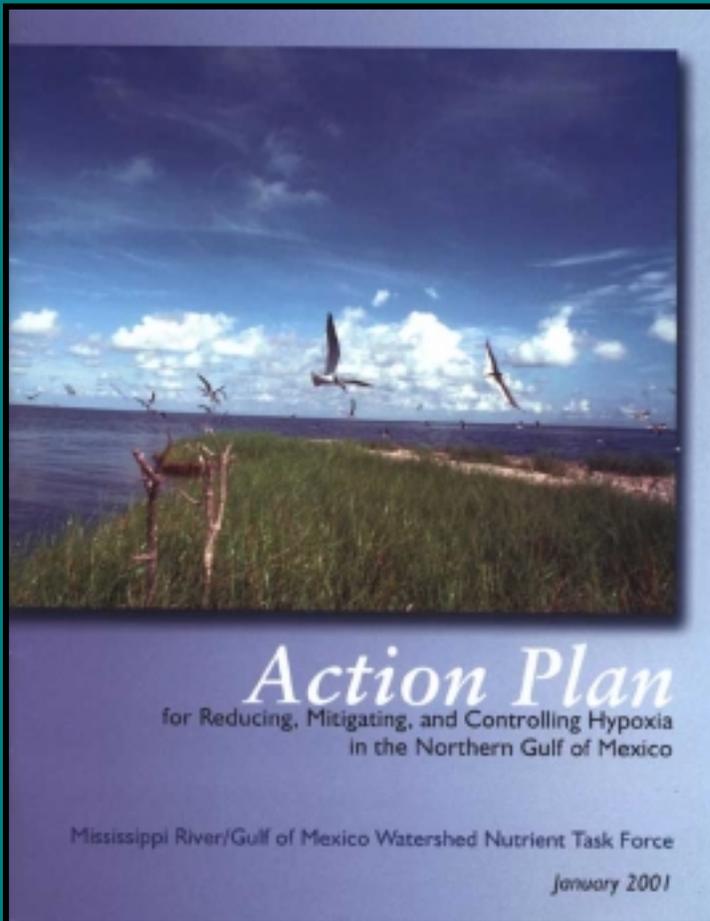


1955-70 Avg. = 350,000 t/yr

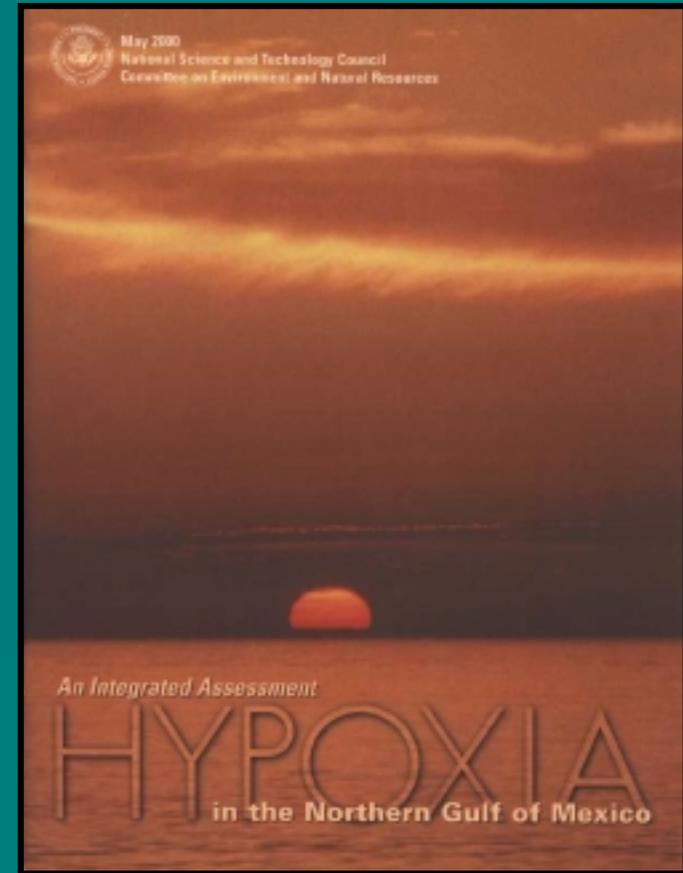
1980-99 Avg. = 950,000 t/y



MR/GM Watershed Nutrients Task Force



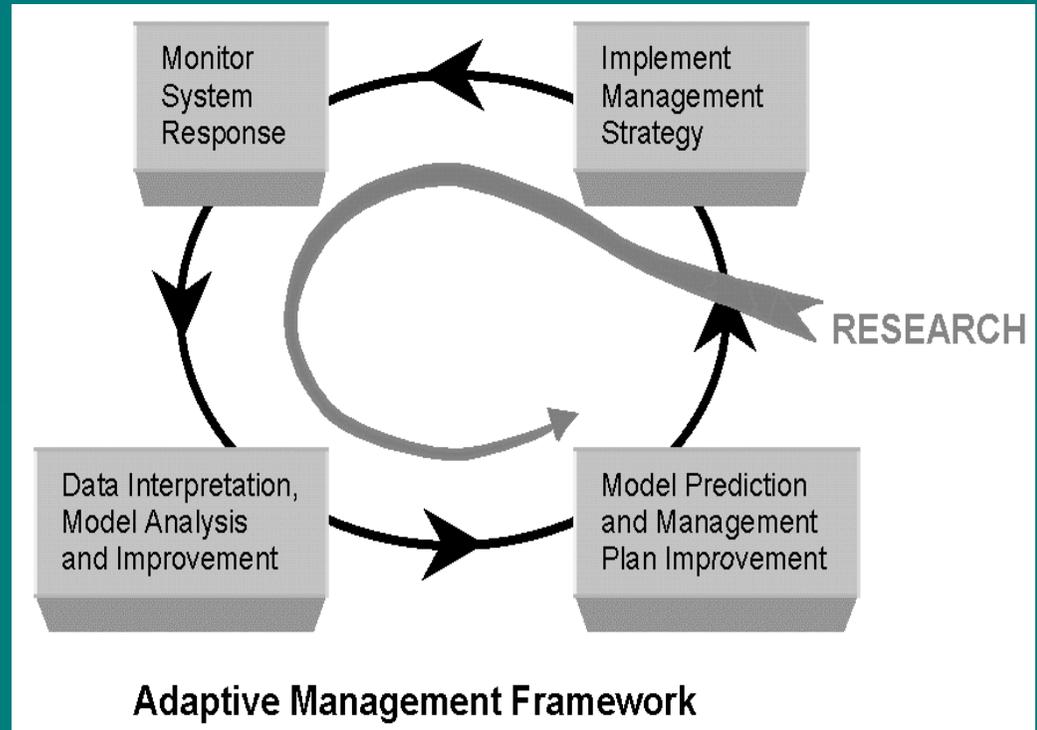
Task Force Action Plan,
January 2001



CENR Science
Assessment,
May 2000

A Science-based Action Plan

- Adaptive management.
- Consider all sources and mitigating actions.
- Voluntary Basis.
- Watershed and Gulf goals.



Reducing Nutrient Loads



Farm N Management



Riparian Forest Buffers

Decreasing
N losses



Filter Strips



Fertilizer Management

Reducing Nutrient Loads



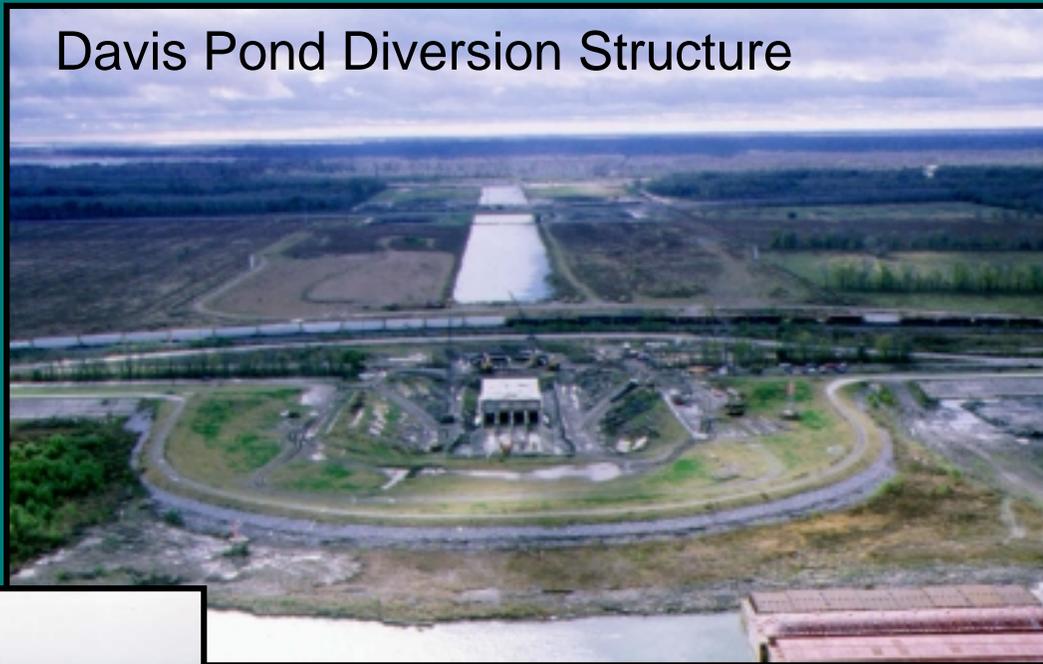
**Reducing
Point Sources
and Urban Runoff**



**Restoring Wetlands
to Increase
Denitrification**

Reducing Nutrient Loads

Davis Pond Diversion Structure



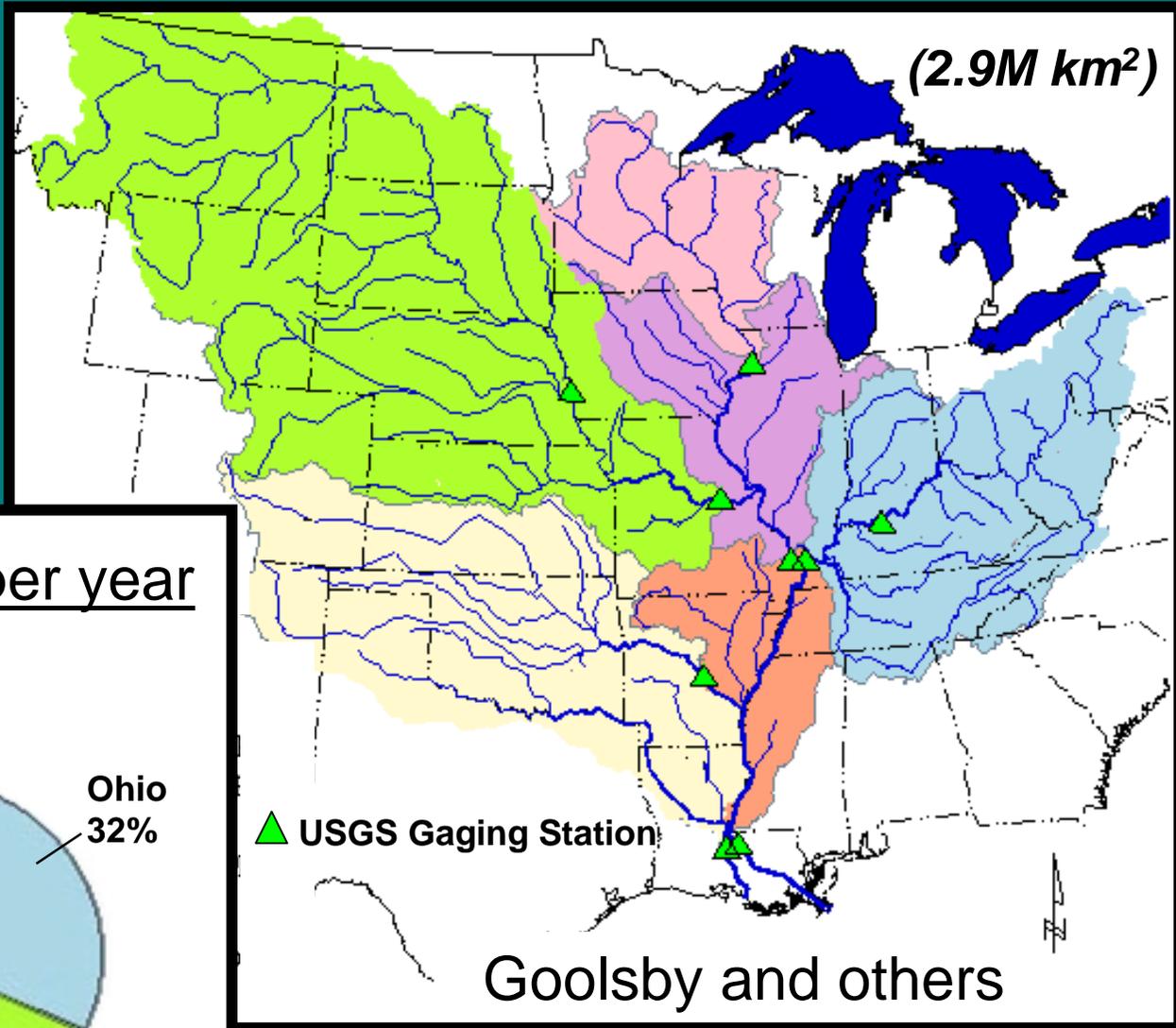
Diversions to
Coastal Wetlands

Increasing Denitrification

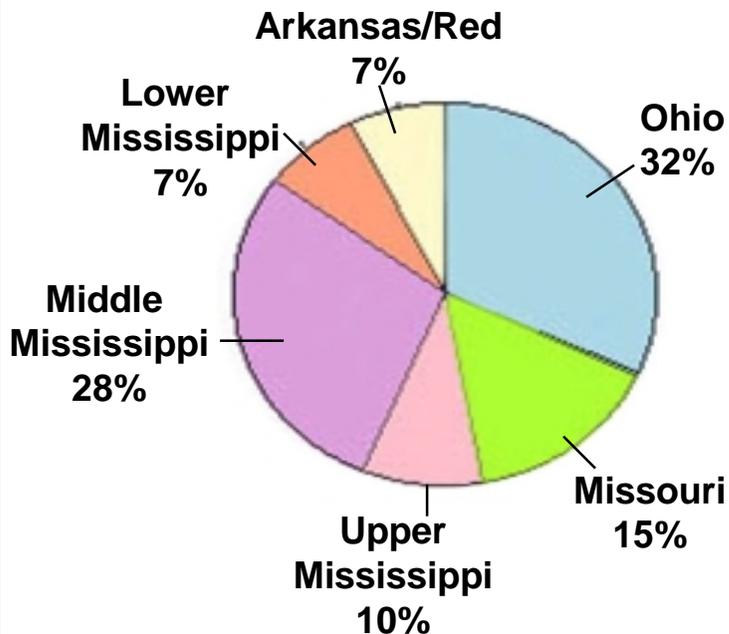
Lock & Dam
Management



Nitrogen Loads, 1980-96



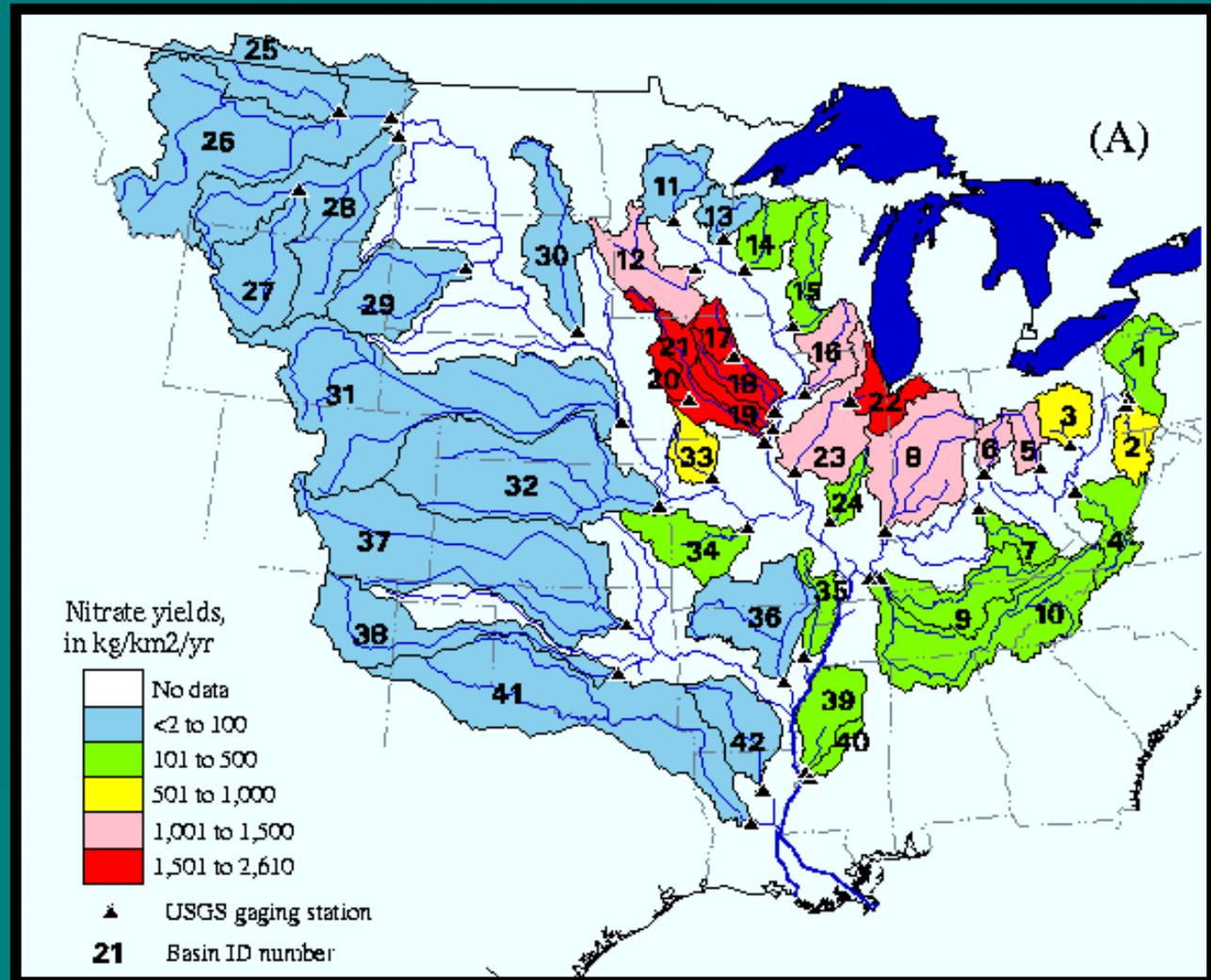
1.6M metric tons per year



1500 Water-Quality Measurements on 9 large sub-basins.

Nitrogen Yield, 1980-96

Yield on 42 small
Sub-basins
calculated from
>4000 additional
water-quality
measurements.

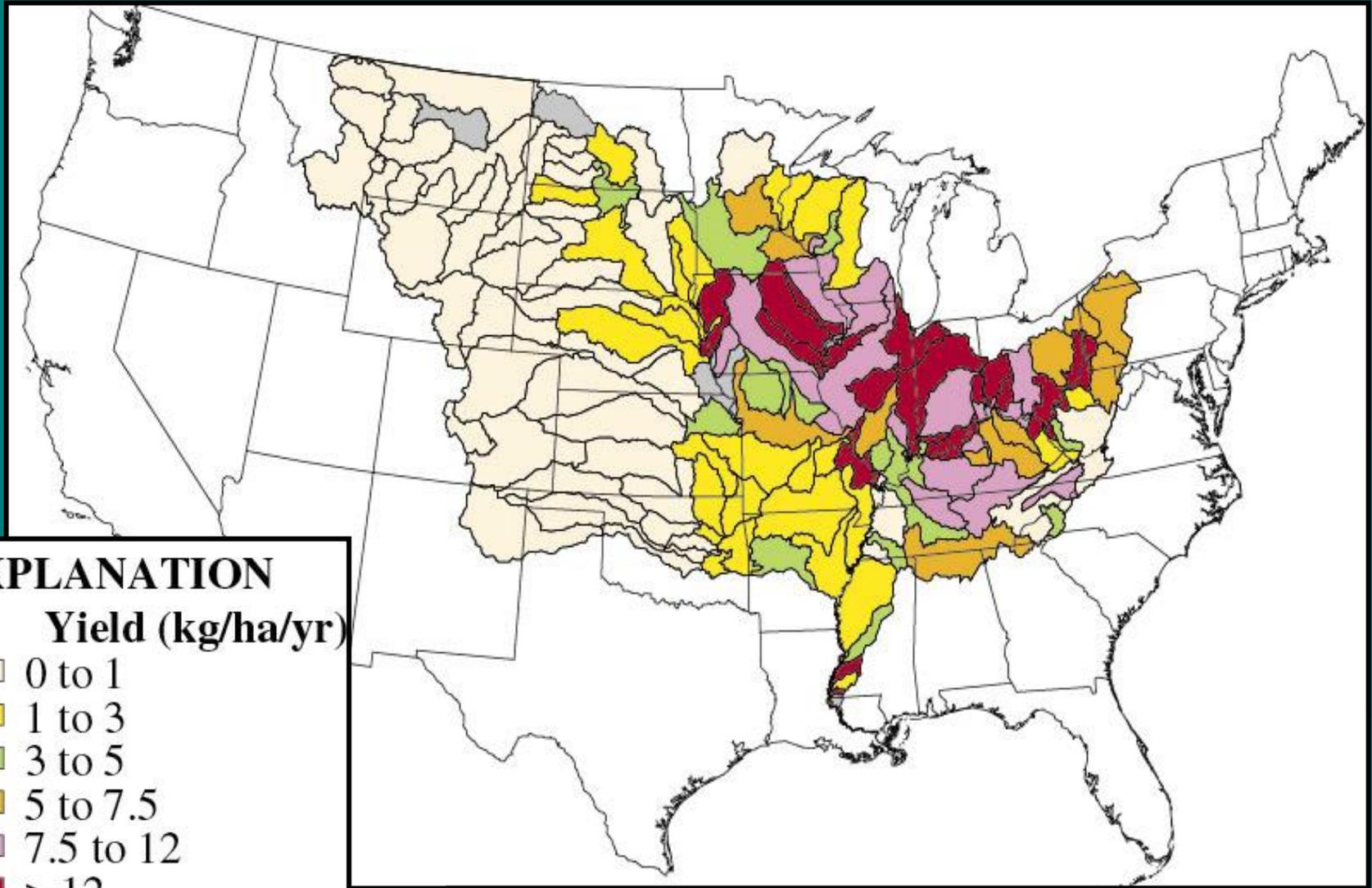


Goolsby and others

SPARROW, a Large River Management Tool

- Extend measurements at representative sites across the basin.
- Define the magnitude and distribution of nutrient loads (losses).
- Comparatively evaluate causal factors.
- Provide a framework for design and evaluation of management actions.

SPARROW: Distribution of Nitrogen Yield



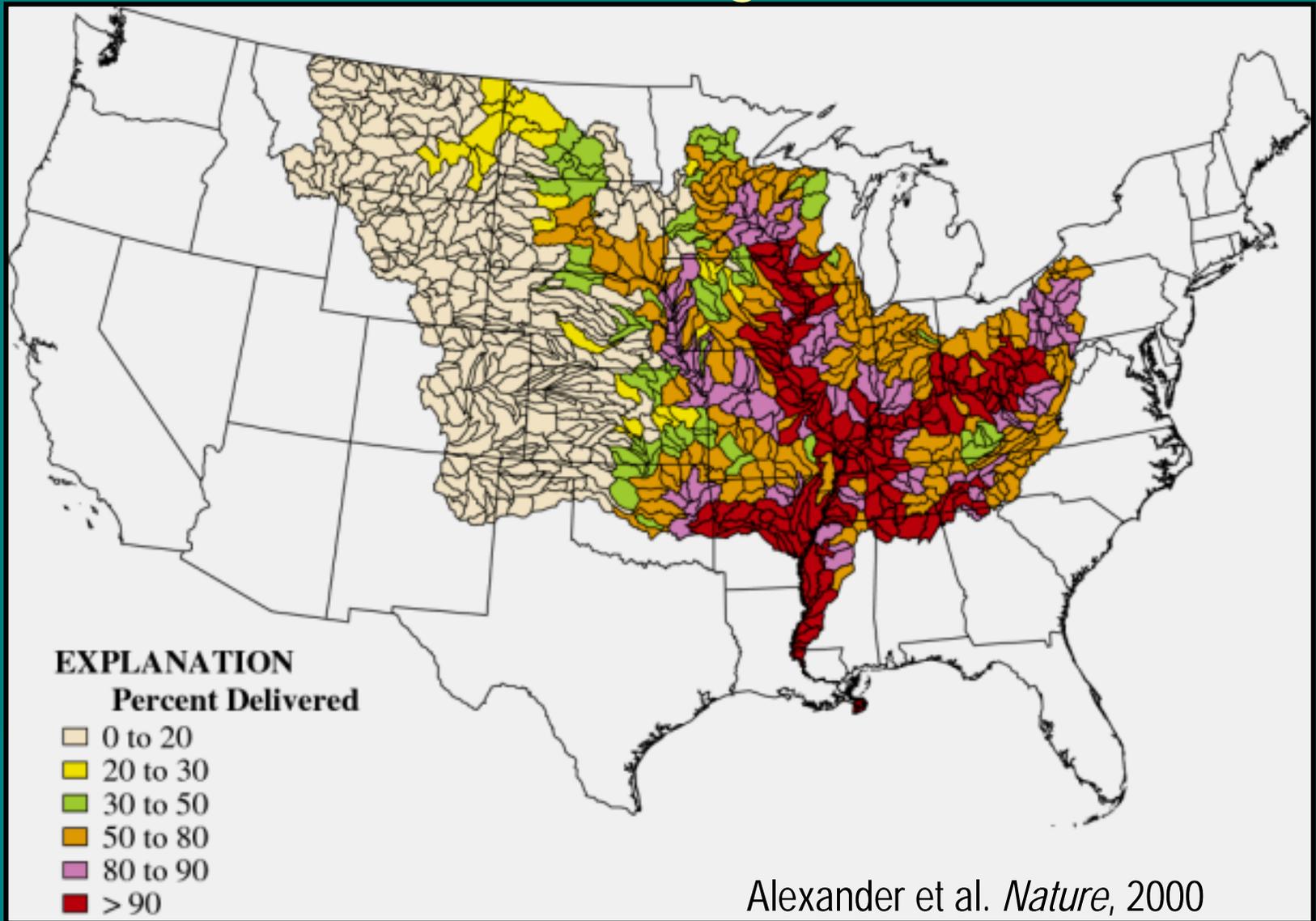
EXPLANATION

Yield (kg/ha/yr)

- 0 to 1
- 1 to 3
- 3 to 5
- 5 to 7.5
- 7.5 to 12
- > 12
- Negative

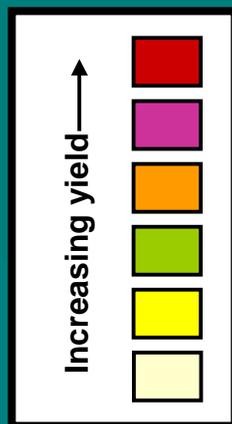
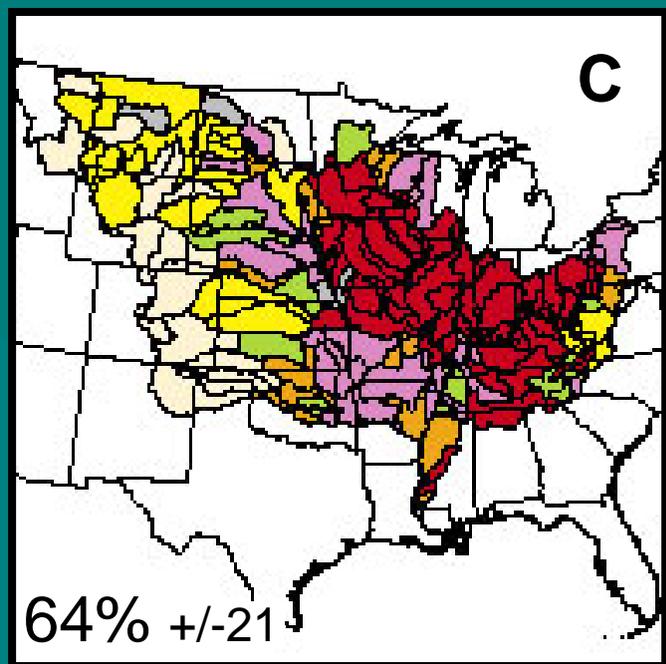
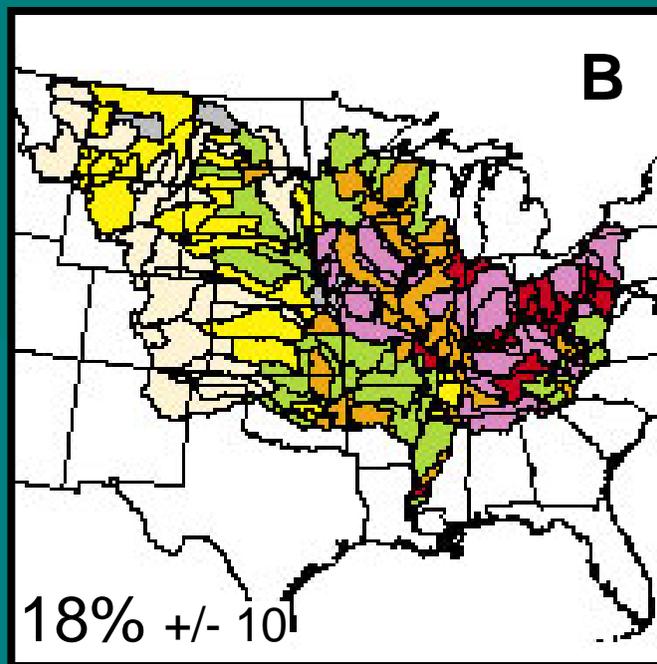
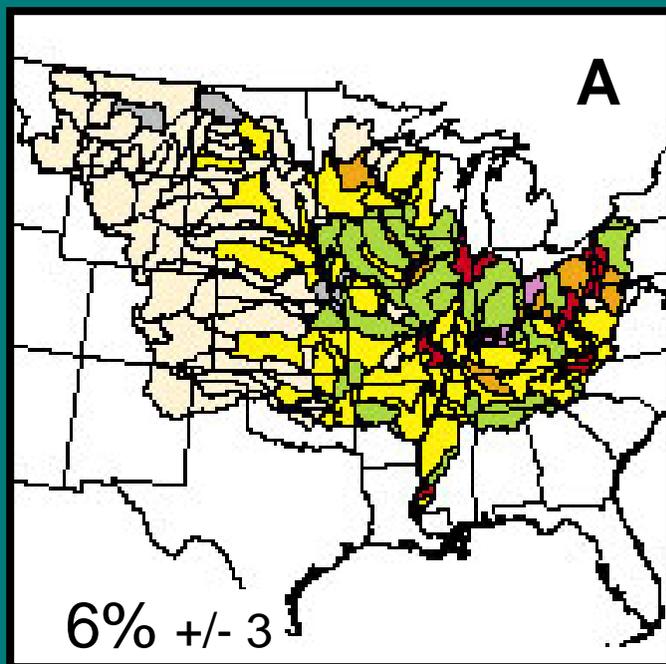
Alexander and others

Fraction of In-Stream Nitrogen Delivered to Gulf

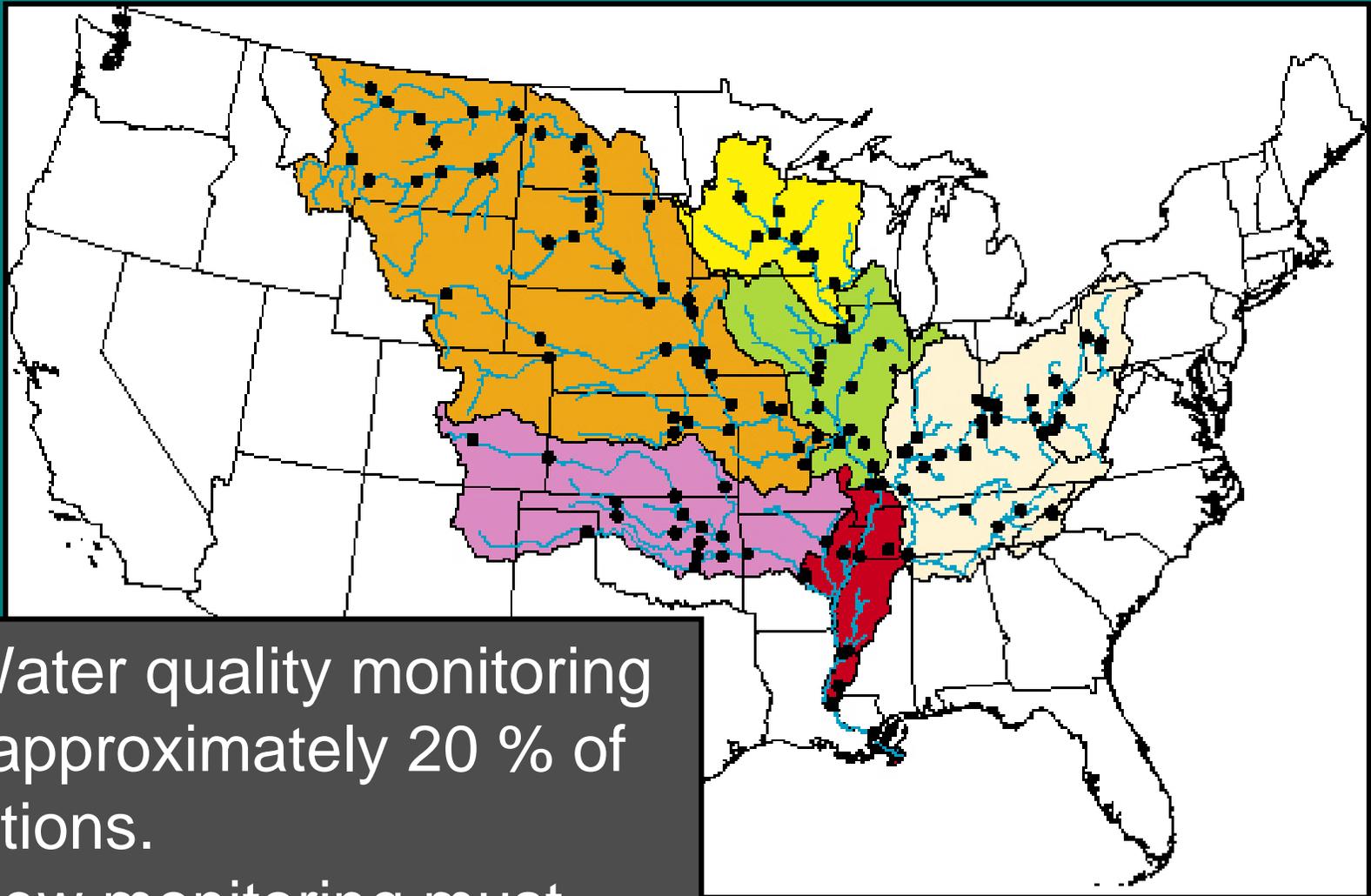


SPARROW Model Estimation of Total Nitrogen Delivered to the Gulf of Mexico from:

- A - Municipal and Industrial Discharges
- B - Atmospheric Deposition , and
- C - Fertilizer and Livestock Wastes.



Monitoring Stations used for SPARROW Model



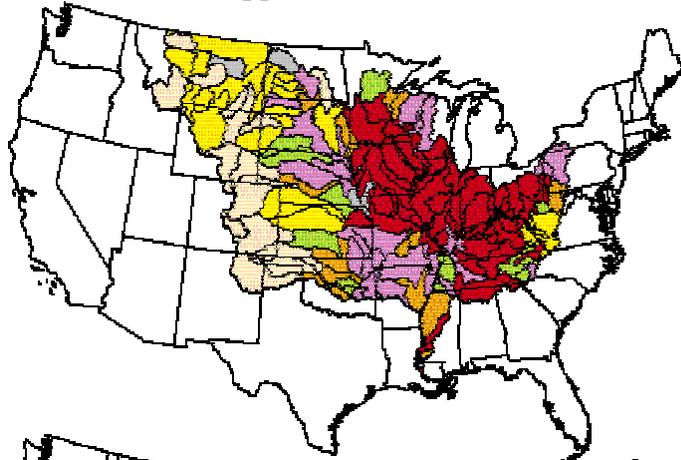
- Water quality monitoring at approximately 20 % of stations.
- New monitoring must include MNGT actions.

For Info on USGS and other activities related to Gulf of Mexico Hypoxia

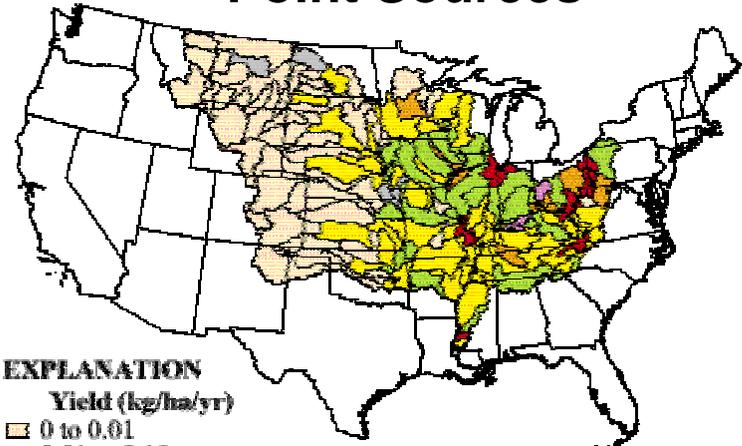
<http://toxics.usgs.gov/>
Click on Investigations

Total Nitrogen Yield Delivered to Gulf of Mexico

Agriculture



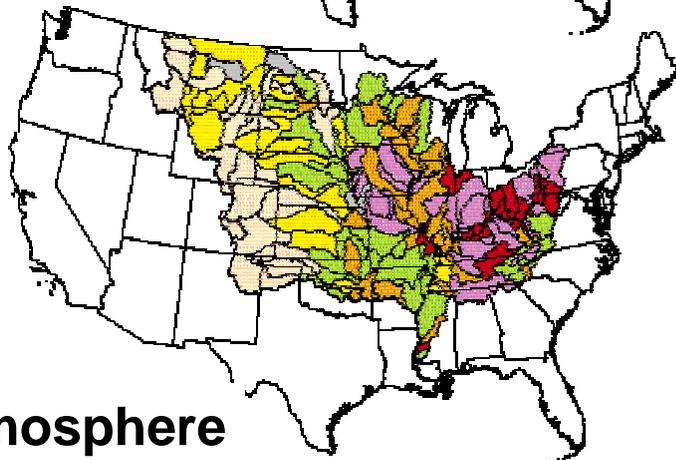
Point Sources



EXPLANATION

Yield (kg/ha/yr)

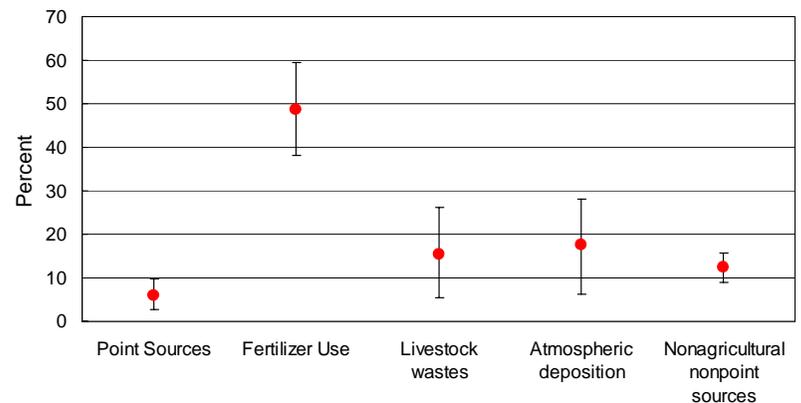
- 0 to 0.01
- 0.01 to 0.10
- 0.10 to 0.50
- 0.50 to 1.0
- 1.0 to 2.0
- > 2.0
- Negative



Atmosphere

Alexander et al. Nature, 2000

Nitrogen Flux from the Mississippi River to the Gulf of Mexico: Share from Major Sources (with 90 percent confidence intervals)



USGS Info On the Internet

Hypoxia in the Gulf of Mexico:

<http://wwwrcolka.cr.usgs.gov/midconherb/hypoxia.html>

Flux and Sources of Nutrients in the MARB:

http://www.nos.noaa.gov/pdflibrary/hypox_t3final.pdf

Nitrogen in the Mississippi Basin – Estimating Sources and Predicting Flux to the Gulf of Mexico:

<http://ks.water.usgs.gov/Kansas/pubs/fact-sheets/fs.135-00.html>

Other Info On the Internet

EPA Mississippi Basin Home Page:

<http://www.epa.gov/msbasin/>

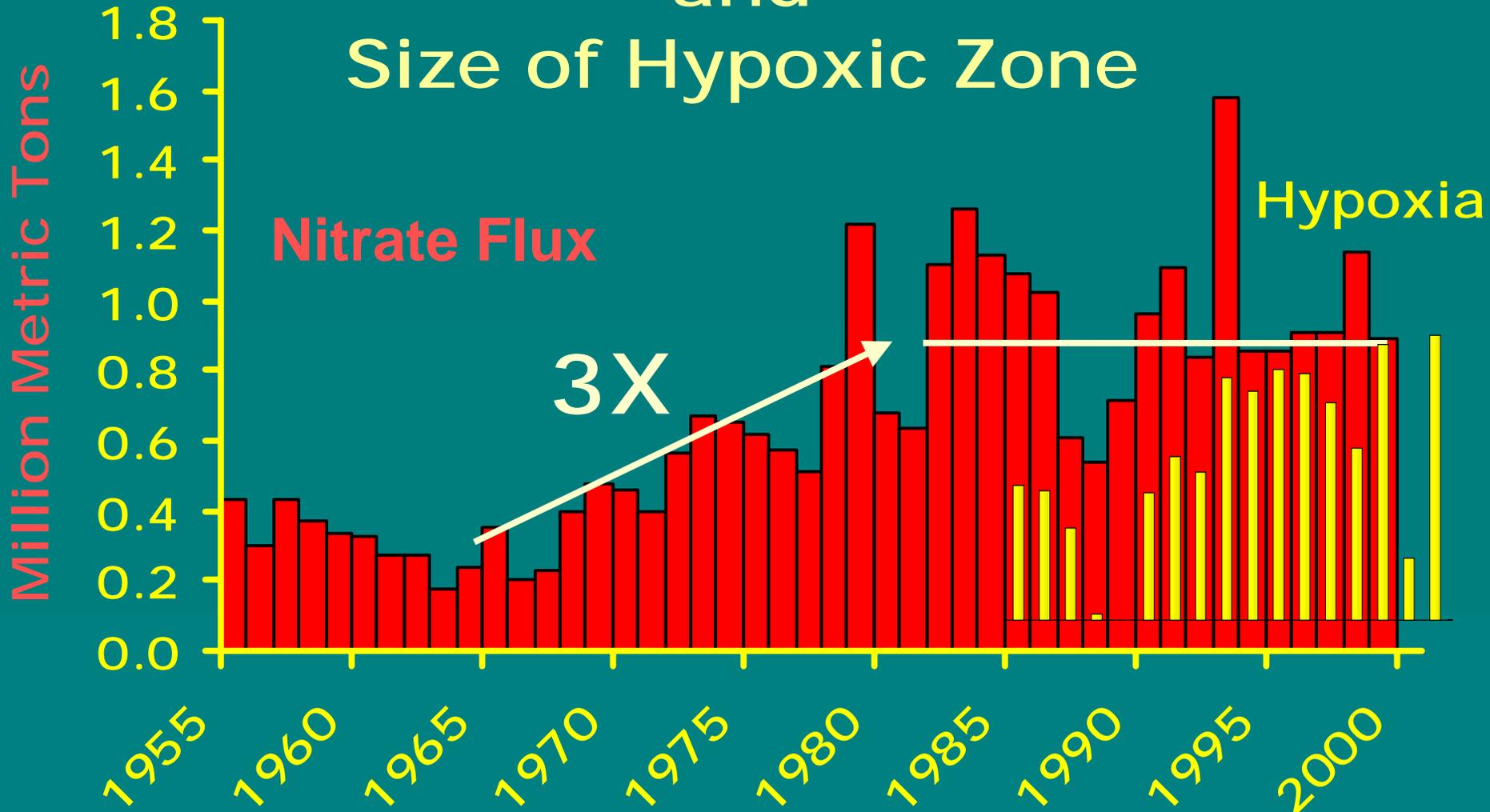
Gulf of Mexico Ecosystems and Hypoxia assessment:

http://www.cop.noaa.gov/Fact_Sheets/NGOMEX.htm

Integrated Assessment of Hypoxia in the Gulf of Mexico:

http://www.nos.noaa.gov/products/pubs_hypox.html

Nitrate Flux to the Gulf and Size of Hypoxic Zone



Goals for the Gulf and the Basin

- Coastal Goal: By 2015, reduce the average zone to $< 5,000 \text{ Km}^2$.
- Within Basin Goal: To restore and protect the waters of the 31 States and 77 Tribes in the Basin.
- Quality of Life Goal: Improve the communities and economic conditions across the Mississippi Basin.

Extrapolated Nitrogen Yield, 1980-96

Statistical extrapolation from representative basins (from 42 measured Sub-basins to 133 Sub-basins of entire Mississippi Basin).

